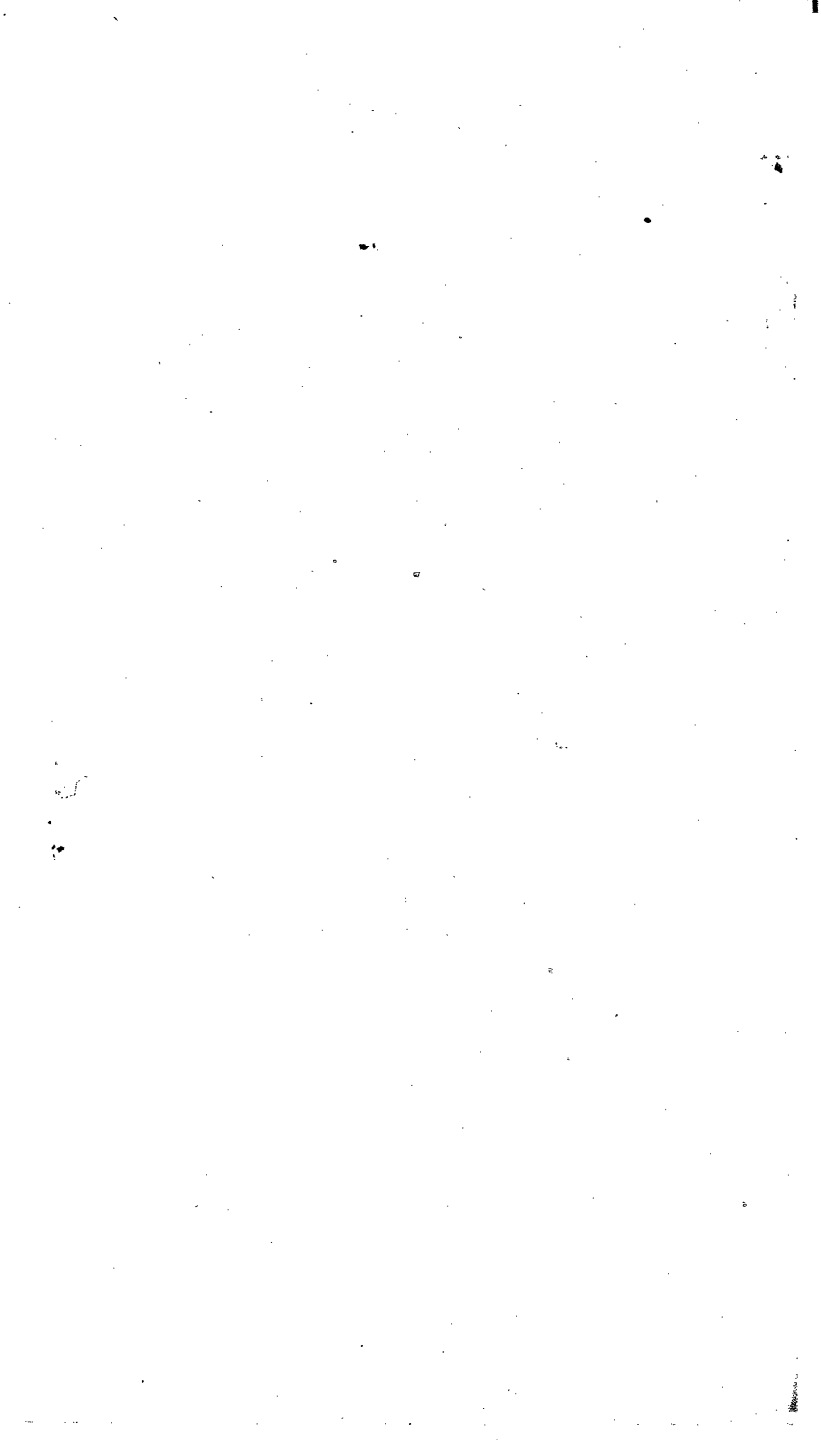


# THE PHILIPPINE ISLANDS

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PANAMA PACIFIC  
INTERNATIONAL EXPOSITION  
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## GOLD IN THE PHILIPPINES

**A**S has been often remarked, there is scarcely a province in the Philippine Islands where gold is not obtained in small quantities by Filipinos who are skillful at panning, and clever at recognizing the evidences of mineralization. Because of primitive methods and equipment, only shallow alluvium and free-milling surface ores have been accessible, but operations in this field are of exceeding long standing and of considerable magnitude. It is reliably stated that Chinese writings of the third century, A. D., report gold as the principal product of Luzon. The Spanish explorers, with their traditional lust for gold, were quick to discover and take advantage of this resource in the Philippines, yet the best Spanish records indicate that mining was carried on with more energy before the Spanish conquest than it was afterwards. Early in the seventeenth century the production from one district near Paracale, Camarines, was about \$200,000 per year. It is significant that, with all the mining activity following American occupation, prospectors have been guided principally by the evidences of former Filipino workings, and no important deposits have yet been located which are not literally honey-combed at the surface with the shallow pits and tunnels of these olden days.

The workable deposits of gold in the Philippines have been found principally in rocks of Tertiary or more recent age, although it is well established that crystalline and metamorphic rocks, which are generally believed to be the earliest part of the Philippine geologic column, carry almost invariably a trace of gold.

The economically important mineralized areas

have been found usually associated with intrusions through the older rocks and into overlying, more recent andesites and other surface rocks, including, in rare cases, sedimentaries. The gold is found usually in true veins or filled fissures, but the walls are often much mineralized and are not sharply defined. Quartz is the commonest gangue mineral, and the principal mineralized districts show evidences of extensive silicification outside the veins



Native miners at work in drift of eastern mine.

proper. Calcite is also a common gangue, and ribbon structure with alternate bands of quartz and calcite is characteristic of the ore in several of the producing mines. The veins which are filled exclusively with calcite, however, are usually leaner in values than the straight quartz veins. Likewise, oxides of manganese are characteristic gangue constituents. The ores which are at present exploited commercially are usually of manganiferous quartz-calcite composition.

Pyrite is always found in the gold-bearing quartz, and not infrequently copper sulphides accompany the pyrite. Gold associated with galena is less common, but has been noted especially in calcite veins in slate. Silver occurs with the gold apparently as an alloy in proportions varying up to 20 per cent of the gold.

A striking feature common to all the principal gold districts in the Philippines is the large number of veins which are to be observed. The veins which are being exploited vary in width up to 130 feet; but usually the values are not of economic importance throughout such great widths. The average tenor of the commercial ores is from \$10 to \$15 per ton. It is commonly found that the ore is not uniform but that both richer and poorer assays are obtained from samples across a vein of this average value.

The typical Philippine ore is not free milling; only about 30 per cent of the gold can be obtained by amalgamation. The ores yield readily to cyanide treatment, and all the operating mills employ this process of extraction.

The principal gold-mining districts in the Philippines are the Baguio and Lepanto regions in the Mountain Province, the Aroroy district in Masbate, the Paracale district in Camarines, and the Cansuran district in Mindanao. The first two are lode-gold district; the last two are placer-gold districts.

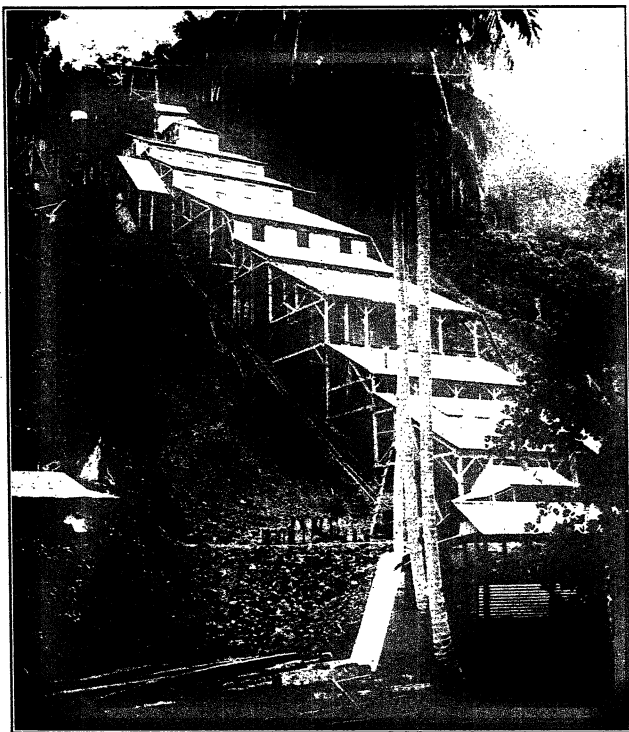
In the Lepanto district there has been no attempt to recover gold by modern processes; the only production is from the operation of the native inhabitants, particularly the Igorots.

In the Antamok and Gold Creek Valleys near Baguio there have been several mills in operation since American occupation. The Headwaters, Benguet Consolidated, the Bua, and Camote-Clayton on Antamok River, and the Major mines on Gold Creek, have all had mills in operation throughout short

periods. The mills of the Benguet Consolidated and the Bua mines operated successfully until they were destroyed by floods. Antamok River is subjected to violent freshets, and the mill of the Benguet Consolidated Company was destroyed, rebuilt, and destroyed again in this way. The owners have recently succeeded in interesting the required capital, and have purchased the machinery for another larger mill which will be erected during the next few months. The Bua has never recovered from the loss of its first mill. The Headquarters mine has a 10-stamp cyanide mill which is at present idle. The Headquarters property is generally considered favorably, but through failure to maintain exploration, the ore supply is not at present adequate to the requirements of the mill. The Camote-Clayton is a small property with an improvised 3-stamp amalgamation mill which has been a consistent, though small, producer for several years. The Major mine supported a small mill for a short period of operation, but is now closed. The principal difficulty with all these properties has been lack of capital.

The ores in the Baguio district include both calcite and quartz ores and ores composed of an intimate mixture of these gangues. Manganese is prominent in most of the ores. There is an exceedingly large number of veins in the Baguio district. These veins in the Antamok Valley appear to be related genetically to an intrusion of quartz diorite into overlying volcanic rocks. In the Gold Creek Valley sedimentaries are found in the overlying rocks, and the ore body of the Major mine is located more or less closely upon the contact of sedimentaries with the intrusion. Aside from the mines which have operated, there are a number of promising claims under exploration. In the valley of Antamok River, particularly, there are large bodies of quartz ore, and it would seem that intelligent application of modern methods of treatment might be suc-

cessfully employed if several of such properties could be consolidated. The ore which has been milled in the past carried from \$10 to \$12 gold per ton. Occasional assays showing a much higher value have been obtained, but it is probable that



Colorado gold-extraction mill.

if larger-scale operations were initiated they should depend upon ore of somewhat lower grade than that which has so far been treated.

In the Aroroy district in Masbate the ore veins are in andesite, and are filled with manganiferous quartz-calcite ore. The district is situated upon the intersection of two prominent tectonic lines, and

fissuring with subsequent mineralization has been extensive. The principal mines are the Colorado, the Syndicate, and the Keystone. Each of these properties has a developed ore body, and is equipped with a mill designed for extraction of fine grinding and cyanidation. The combined capacity of these mills is from 250 to 300 tons per day, and the ores carry from \$10 to \$15 per ton in gold.

The Colorado mine has been operating consistently for three years, and has made an enviable record. The Syndicate and Keystone mines began operation early in 1914, and there is every reason to believe the district will continue to produce for an indefinite period. As in the Baguio district, there are numerous prospects around Aroroy, and considerable areas of promising country which have not yet been prospected.

The Paracale district in Camarines Province is essentially a placer-gold district, although lode mining has been attempted there in the past. It was this district which first attracted the attention of Spanish explorers, and from which the principal Spanish production came.

The gold at Paracale occurs in veins which are largely confined to a comparatively small area of granite which is apparently intrusive, with an older peridotite on one side and Tertiary sedimentaries on the other. Region metamorphism has rendered the granite gneissic with peridotite schistose, and has folded and crumbled the sedimentaries.

The San Mauricio mine workings are in the granite near its contact with the schist. The ore is refractory with a gangue of quartz and with copper and iron sulphides, but, unlike the Baguio and Aroroy ores, contains neither manganese nor calcite. The Tumbaga mine has worked upon small calcite veins and stringers in slate and andesite near the contact of the granite with the sedimentaries. The Tumbaga ore is strikingly rich in free gold which is as-



sociated in the calcite with galena. Telurides have been detected in the Tumbaga ore, an occurrence



The Gumaus dredge "Governor Gilbert."

which, so far as known, is unique for the Philippine Islands.

The placer deposits in the Paracale district are

exploited entirely by dredging. At the present time 7 large dredges are in operation, and additional dredges are under construction. The dredging is divided between American and Australian capital, and, in consequence, two types of dredges have been introduced, both of which are operating with apparent satisfaction to their respective owners.

The gold is confined to a thin bed of sandy gravel, and is buried beneath from 30 to 50 feet of barren clay overburden. The bed rock is gneiss and schist, and affords a good floor upon which to work. The gold-bearing bed varies from a few inches to a few feet in thickness, and is exceedingly rich. The Gumaus Company operating in ground up to 52 feet in depth, and with pay gravel never more than a few feet in thickness, has taken out values which make the average of all the material handled nearly 50 cents per cubic yard. The Paracale gold is usually fine, very sharp, and often crystalline. It is not uncommon for the dredges to bring up quartz bowl-ers carrying considerable visible free gold. There is every indication that the gold-bearing gravel has not traveled far, but lies near the vein from which it was eroded. Each of the several rivers upon which dredges are working in the Paracale district are tidal, and the operations are carried on in brackish water. The dredges use wood from the surrounding mangrove swamps for fuel. The combined production of the Paracale dredges was about \$335,000 during 1913 and about \$400,000 in 1914.

The principal holding company in the Cansuran district in Surigao is the Cansuran Placer Company which has just completed the installation of a hydraulic mining plant. The Cansuran property lies on the extreme northern part of Mindanao Island, in a district which has long produced gold through the efforts of Filipinos. The values on the Cansuran Company's claims have been estimated by conservative engineers as at least two and one-half

million dollars. The gold in this district is found in both modern and older gravels in an upland region. The gravels are 10 to 15 feet thick, and consist principally of sand and small pebbles. The gold is well rounded and comparatively coarse. A number of nuggets weighing as much as 30 grams have been recovered from the claims which are to be exploited. Very little is known of the geology of the region, but the gravels generally lie upon a schist, and appear to have been carried down from the mountains, which lie farther inland.

Minor Philippine gold-producing districts include a large area of placer ground in Nueva Ecija Province, which is of comparatively low unit value. The exploitation of this district has been prevented by the low value and by the character of the deposits which contain a great deal of clay.

The Umerai Gold Limited operates a dredge on Umerai River in Tayabas Province on the east coast of Luzon. This dredge has not been operating long enough to prove the value of this region. A number of claims have been located on the Umerai River, and the few tests which have been reported indicate commercially important placers.

Mindoro Island has received considerable attention from prospectors, and it is known that gold occurs on several of the larger rivers. The most promising samples have been obtained on Binabay River in the northern part of the island. Here, as in Surigao, the gold is coarse and rounded, several nuggets of 10 grams' weight having been brought in.

Catanduanes Island in Albay Province is known to contain two small placer-gold areas, but these have not as yet been exploited.

The mining laws of the Philippine Islands are based on those of the United States. The principal point of difference is that the Philippine law grants no extra-lateral rights. Each locator is entitled to one claim only upon a single lode in the Philippines.

All dimensions are stated in meters, lode claims being 300 meters square. There is an export tax of \$1 per ton on Philippine ores.

The total gold production for the Philippine Islands has grown from less than \$100,000 in 1907 to more than \$800,000 in 1913, while the production in 1914 will be about \$1,125,000. The gold production in the future will come from both the placer-gold and the lode-gold deposits, and it may be expected that the supply from both sources will be materially increased and will be maintained for an indefinite time. The local conditions are such that adequate capital is essential to the success of even small enterprises. The Philippine mining industry is emphatically not a poor man's field. The comparative slowness with which gold mining has progressed in the past has been due in great part to lack of capital, and satisfactory progress in the future is conditioned absolutely upon a sufficient investment.

